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Two winter grains are grown in Alberta with some success, namely winter rye and winter wheat. As crops they have a number of distinct advantages over spring grains but they sometimes are more severely damaged by certain pests than spring grains and may winter-kill in some years and in some parts of the province. Of the two, winter rye is the more widely adapted and the more certain as a crop (Figure 1).

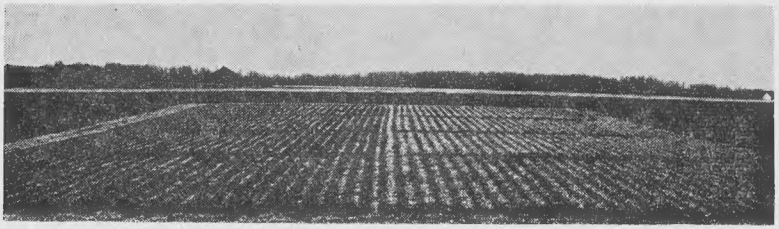

Figure 1.—Winter grain seed treatment plots at the University of Alberta as they appeared in the spring of 1950, showing winter wheat at the left and winter rye on the right of centre. The poor stand in rows 8-10 of the front block of winter rye resulted from treatment of the seed with formaldehyde. (photo by E. A. Peterson)

In order to grow winter grains successfully in Alberta, it is essential to use only the hardiest varieties and to provide the best growing conditions possible for them. To secure good stands and to give these crops a good start it is important to use good seed and to prepare it in the best possible way.

Should Winter Grains Be Treated?

In the preparation of the seed of winter grains for seeding, seed treatment is as necessary and as important as for spring grains and possibly even more important. Yet, judging from inquiries received and from other sources of information seed treatment of winter grains is often omitted entirely or given without too much regard of the effects it may have. In this connection it is well to remember that bad treatment may be worse than no treatment. Good treatment may, on the other hand, do much to give the crop

a good start and to keep it healthy throughout its life. While winter wheat is quite commonly treated in Alberta, it appears that winter rye is seldom treated. Yet both of these winter grains may benefit from seed treatment and therefore should be treated.

Reasons for Seed Treatment of Winter Grains

The following are the more important reasons for treating the seed of winter grains:

1. to control diseases caused by seed-borne micro-organisms
2. to protect the seed from decay in the soil
3. to avoid the introduction and spread of new seed-borne pests

Winter wheat and winter rye are both subject to smut diseases and to certain other diseases caused by seed-borne fungi. Seed treatment is helpful in the control of such diseases and therefore in promoting healthier crops than may be obtained if the seed is not treated.

Seed treatment with certain fungicides is of value in protecting seed from decay in the soil. This is particularly true where soil conditions after seeding are unfavorable for germination and where the seed used is damaged in some way. Both winter rye and winter wheat are hulless grains and are consequently more vulnerable than hulled grains such as ordinary oats and barley. Both are subject to injury in threshing and this is likely to make them highly susceptible to decay in the soil. The seed of winter rye is very easily injured in threshing and consequently especially needs seed protection.

The danger of introducing new pests or new strains of old pests of winter grains to Alberta farms is a real one and should be avoided if at all possible. For instance, the fungus causing Stem Smut of rye is a serious pest in the United States and in other countries. It has been found in Alberta but apparently is not widely distributed. Also there are virulent known strains of the fungus causing Covered Smut of winter wheat in the United States and elsewhere which are not as yet known in Alberta. These and other pests can readily be introduced with infested seed and if introduced can be spread from farm to farm. Seed treatment is one means of reducing these dangers.

Limitations of Seed Treatment

While seed treatment of winter grains has definite value and provides good insurance for the money, time and labor invested in it, one should not expect too much of it. It will not bring dead seed back to life nor will it prevent all diseases. Many diseases of winter grains are caused by agencies which are not seed-borne or if seed-borne are carried from one crop to the next in other ways as well. For the control of such diseases, seed treatment is likely to have no

value or quite limited value. Seed treatment will not control the rust diseases of winter grains since the fungi causing these are air-borne rather than seed-borne. As ordinarily practised, seed treatment also has little or no place in the control of Ergot, one of the major diseases of rye. It is true that the fungus which causes Ergot is commonly present in seed samples in the form of black kernel-like bodies. These, if sown with the seed, and if deposited near the soil surface may be instrumental in initiating the disease in the developing crop. Now ordinary seed treatment practices do not destroy these bodies and even if they did the development of the disease might not be prevented, since the inoculum which is most likely to initiate infection is likely to come from sources other than the seed. Then too, winter grains may be seriously damaged by root-diseases which are caused to a large extent by fungi which are carried over from one season to the next by infested crop residues left in and on the soil, rather than by the seed. The destructive fungus which causes Take-all, one of the major pests of winter wheat in Alberta, is an example of the latter. Seed treatment has practically no value in its control.

In view of the above facts one should not jump to the conclusion that if one treats his seed all his disease troubles will be over. Neither should one assume that all chemicals used for seed treatment have the same value or will accomplish the same ends.

Effects of Seed Treatment

Chemicals used in seed treatment may destroy injurious organisms carried by the seed, they may protect the seed from injurious organisms present in the soil or they may do both. It is desirable if both can be accomplished by the one treatment, as is the case when organic mercury fungicides are employed. When formaldehyde is used, on the other hand, little, if any, protection is afforded the seed from soil organisms though satisfactory destruction of seed-borne organisms is often accomplished.

The effect of chemical treatment on the seed itself is also important. If the seed is injured by the treatment, more harm than good may result. Our two winter grains are quite easily injured by certain chemicals. Untested chemicals and those known to be injurious such as formaldehyde should be avoided by the farmer.

Seed Treatment Tests with Different Fungicides

Seed treatment tests with different funicides have been made at the University of Alberta for several years. Most of these have been made with a view to determining the relative value of these chemicals as seed protectants. They are known to be effective in the control of covered smuts of cereals at least where soil infestation is not a problem. Where it does occur, as in parts of the United States, seed treatment, at least of winter wheat, does not give satisfactory

control though it may still be advisable for seed protection and for the prevention of other diseases.

In Table I, the effects of different fungicides on the emergence and survival, as measured by the stand alive in the spring, of winter rye and winter wheat sown at Edmonton, Alberta in 1949, are given.

TABLE I

Comparative Effects of Seed Treatment of Winter Rye and Winter Wheat with Different Fungicides at Edmonton

Fungicide	Form	Rate per bu.	Emergence in %		Stand in Spring in %	
			Winter Rye	Winter Wheat	Winter Rye	Winter Wheat
Ceresan	dust	½ oz.	66	88	75	5
Ceresan M	dust	½ oz.	70	82	83	3
Ceresan M	slurry		69	87	80	3
Panogen	liquid		76	87	80	3
Spergon	dust	2 oz.	63	77	80	0
Formaldehyde 1-320	liquid		36	78	58	3
None			63	80	73	3

The tests on which Table I is based were carried out according to the plan illustrated in Figure 1. Kharkov winter wheat and Dakold winter rye were sown at the same time on adjacent areas. The figures in the table are averages of four plots, each plot consisting of three rows. A plot for each fungicide was included in each of the four blocks shown in the picture and in each block the plots for the different fungicides were distributed at random. Thus no treatment was specially favored or handicapped by its location.

Discussion of Results of Seed Treatment Tests

The effect of the first four fungicides listed in Table I, on emergence and stand of winter rye and winter wheat was similar. They tended to improve both emergence and stand rather than to decrease them. These are all organic mercury fungicides which are recognized to have good seed protective properties. The only non-mercury dust included in the tests apparently had little if any protective value though it did not have any appreciable injurious effect. Formaldehyde, however, caused serious injury especially to winter rye. It serves as an example of a fungicide that may do more harm than good.

It is evident from the results obtained in 1949 that the organic mercury fungicides have good protective properties for the seed of winter rye and winter wheat. Coupled with their known effectiveness as seed disinfectants for the control of covered smuts and other diseases, they have much to commend them for the treatment of these grains. Good stands of winter grains are particularly important in areas, such as ours, where winter-killing may occur and seed treatment with such chemicals should help to provide them. The chief

objections to the use of the organic mercury fungicides arises from their highly poisonous character. Attempts to find equally effective fungicides which lack such poisonous qualities are under way in many quarters. Until such materials become available, the use of slurry or liquid forms of the mercury compounds will help to alleviate the poison menace associated with these preparations. One could use Spergon as a less objectionable chemical but it probably would not provide as effective protection as the mercury compounds. Formaldehyde should not be considered for the treatment of winter grains as the seeds of these grains and especially those of winter rye may be seriously injured by it.

It will be noted that results for only one year are given. This seemed advisable since the results for that year are in general quite typical of those obtained in other years for the same or similar fungicides, and since the kinds tested have varied somewhat from year to year. It will also be observed from the photograph and from the table that the winter wheat almost failed to survive the winter of 1949-50, so that the figures for stand of that grain, obtained in the spring, are not of much value except to show its general reaction to winter conditions in comparison with winter rye. The stand figures for winter rye, however, probably are indicative of the comparative effects the fungicides would have had on winter wheat had more survived.

SUMMARY

1. The seeds of both winter wheat and winter rye should be treated with suitable fungicides to protect them from decay in the soil and to control smut and other diseases.
2. The organic mercury fungicides have been found to be effective seed protectants for these grains under Alberta conditions.
3. Formaldehyde has proved ineffective as a seed protectant and highly injurious, especially to winter rye. It should not be used on either winter rye or winter wheat.